NORDTECH

Microelectronics Commons Regional Hub

nordtechub.org

Member Meeting | 13 Oct 2023 | WebEx

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Northeast Regional Defense Technology Hub

Welcome and Thank You!

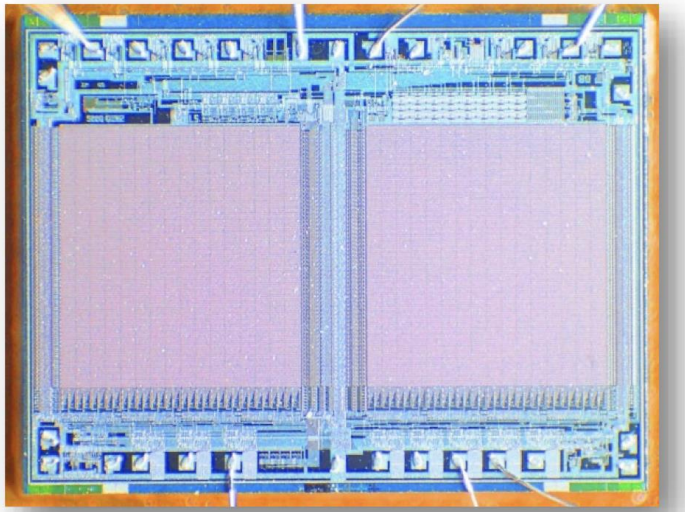
Today:

1. **Microelectronics Commons** – What is it, at this stage?
2. **NORDTECH** – Who are we and what did we propose to do together?
3. **Next steps** – What we know now and what we learn and co-develop next

Microelectronics Commons – What is it, at this stage?

The United States is an Innovative Designer but NOT an Innovative Producer

- The United States is a world leader in microelectronics design.
- But the United States is responsible for only 12% of microelectronics production globally. Most of that production is in Asia.
- Two major roadblocks to domestic production are:
  - Establishing viability and marketability of new microelectronics technologies. Once established, US firms have incentive to invest.
  - Access to facilities for innovators. Researchers in industry and academia do not have access to facilities to explore, prototype, and demonstrate leap-ahead technological advancements.
- The result is significant risk to our microelectronics supply chains leading to:
  - loss of key intellectual property
  - loss of market influence
  - dependency on foreign economies



Source: https://www.cto.mil/wp-content/uploads/2022/11/DoD_Microelectronics_Commons.pdf

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Microelectronics Commons – What is it, at this stage?

Lab-to-Fab Transition of Microelectronics Technologies

Research Universities, Start-ups have facilities for Lab prototyping but face barriers to Technology Demonstration.

Core Facilities or Foundries/Fabs provide access to early stage Fab prototyping.

Microelectronics Commons aims to enable lab-to-fab prototyping– evolve microelectronics laboratory prototyping to fabrication prototyping – in domestic facilities.

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Microelectronics Commons – What is it, at this stage?

The Microelectronics Commons: Innovation from Lab-to-Fab

The Microelectronics Commons is a CHIPS-funded national network that will create direct pathways to commercialization for US microelectronics researchers and designers from “lab to fab.”

The Commons is designed to:

- Enable sustained partnerships between emerging technology sources, manufacturing facilities, and interagency partners
- Develop a pipeline of talent to bolster local semiconductor economies and contribute more broadly to the growth of a domestic semiconductor workforce
- Bridge the microelectronics technological “Valley of Death”
- Expand domestic microelectronics fabrication capability
- Enhance microelectronics education and training pipeline to bolster the microelectronics engineering workforce

Microelectronics Commons – What is it, at this stage?

The Microelectronics Commons

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- 86 teams competed on short fuse
- 8 MEC Hubs selected and announced
- NORDTECH is among the largest of these 8 Hubs

National Microelectronics Commons

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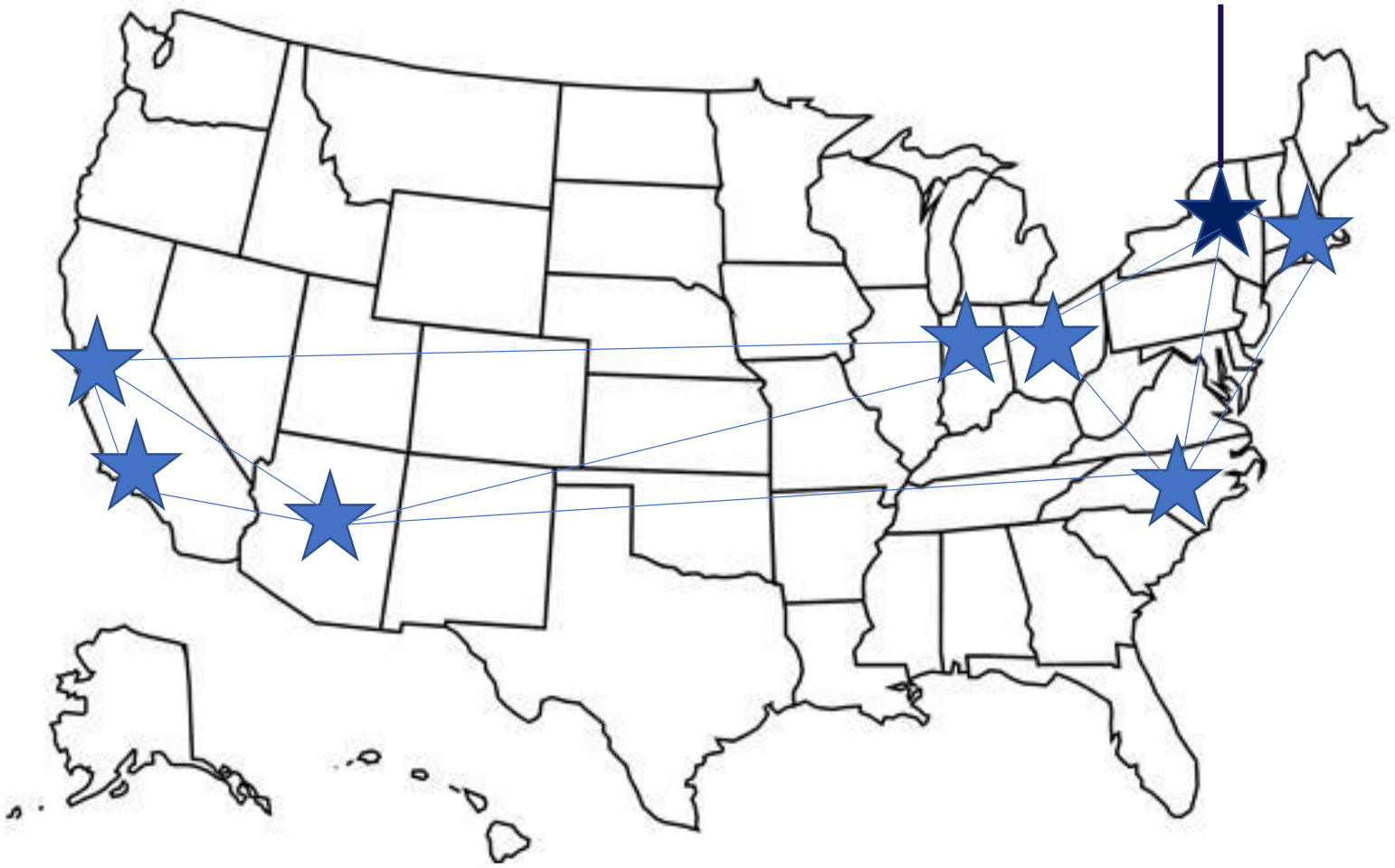
- Northeast Regional Defense Technology Hub (NY)
- Northeast Microelectronics Coalition Hub (MA)
- Silicon Crossroads Microelectronics Commons Hub (IN)
- Midwest Microelectronics Consortium Hub (OH)
- Commercial Leap Ahead for Wide Bandgap Semiconductors Hub (NC)
- Southwest Advanced Prototyping Hub (AZ)
- California-Pacific-Northwest AI Hardware Hub (Northern CA)
- California Defense Ready Electronics and Microdevices Superhub Hub (Southern CA)



Connecting Hubs Across the Country Supporting the U.S. Defense Sector

NORDTECH –

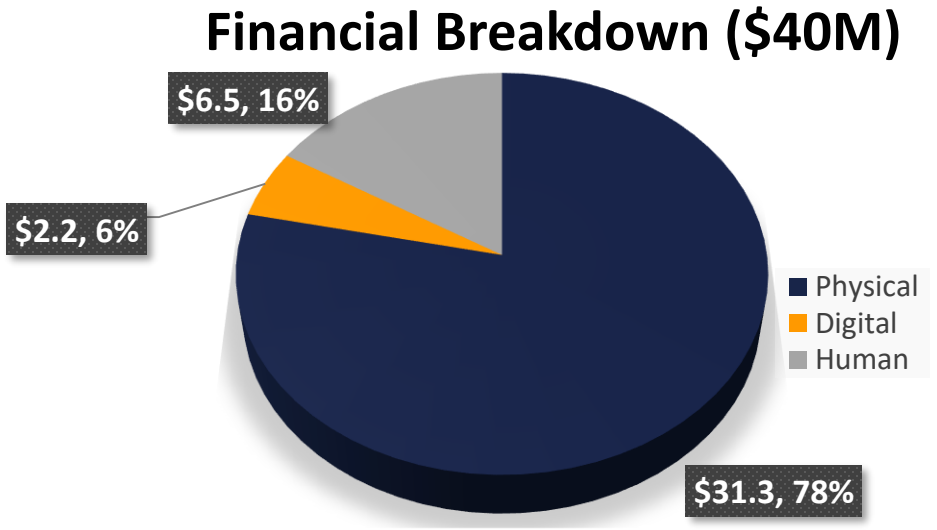
Who are we and what did we propose to do together?

60 Proposal Contributors (Members + Partners)

Steering Committee on behalf of NORDTECH community:

- Cornell University
- IBM
- NY CREATES
- Rensselaer Polytechnic Institute
- University at Albany

Prime: RF SUNY



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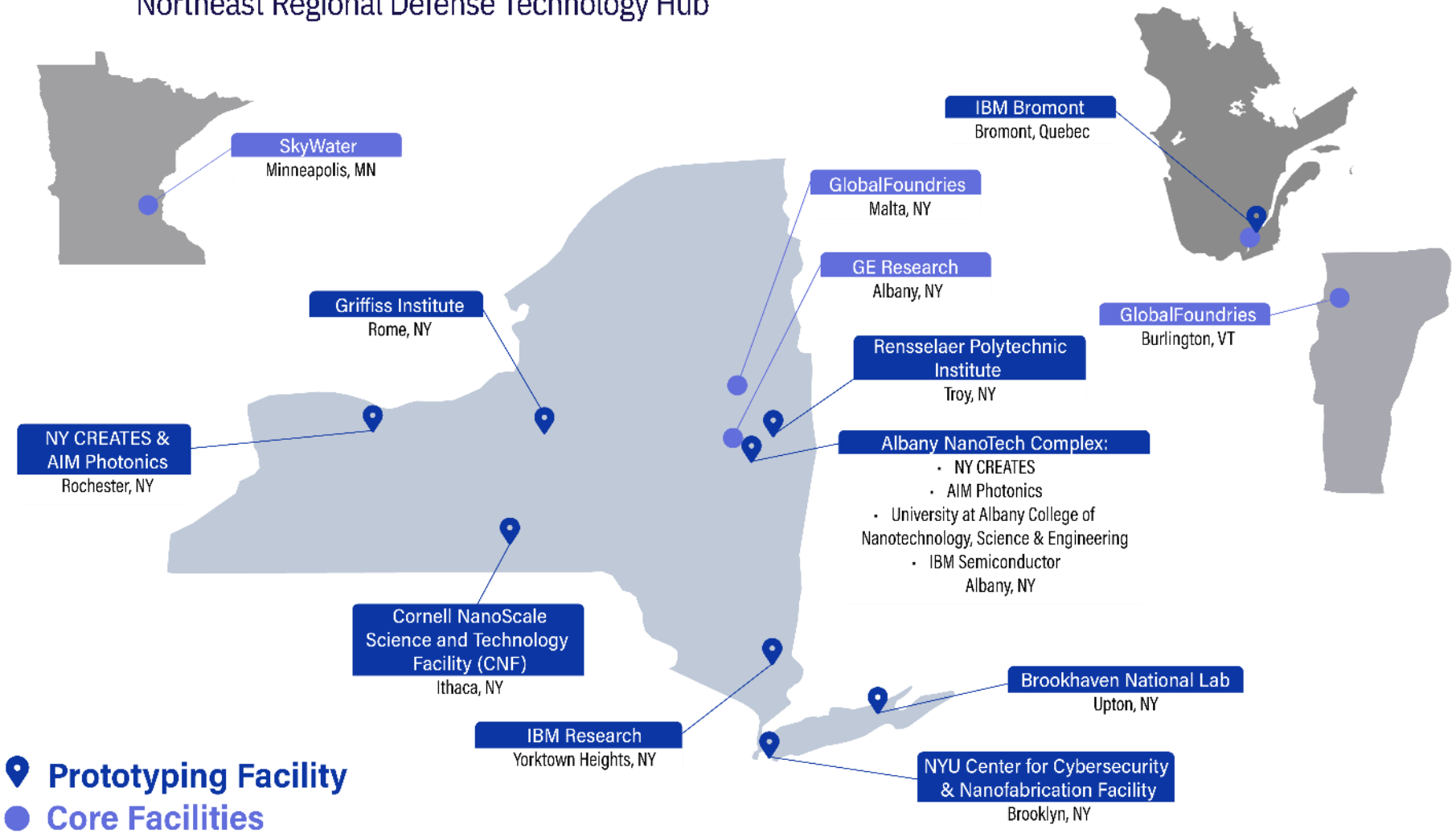
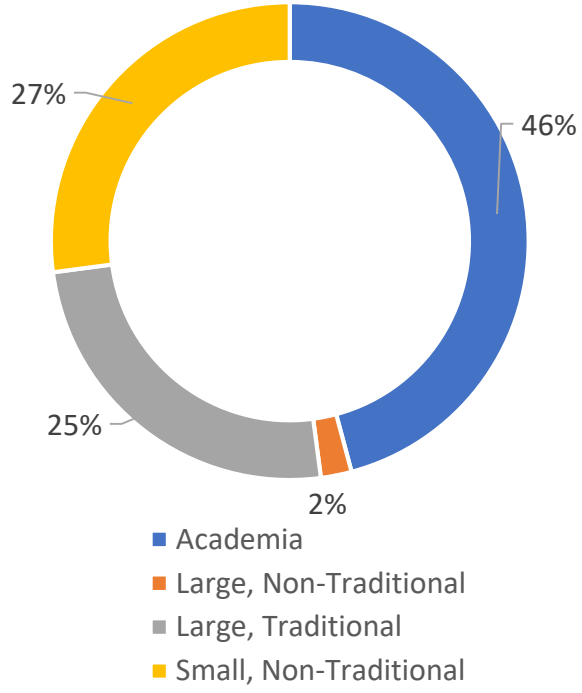
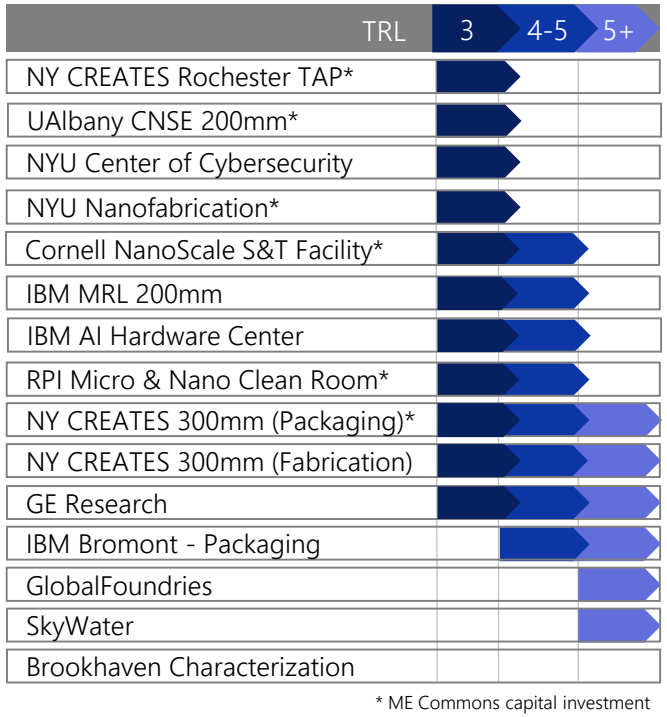


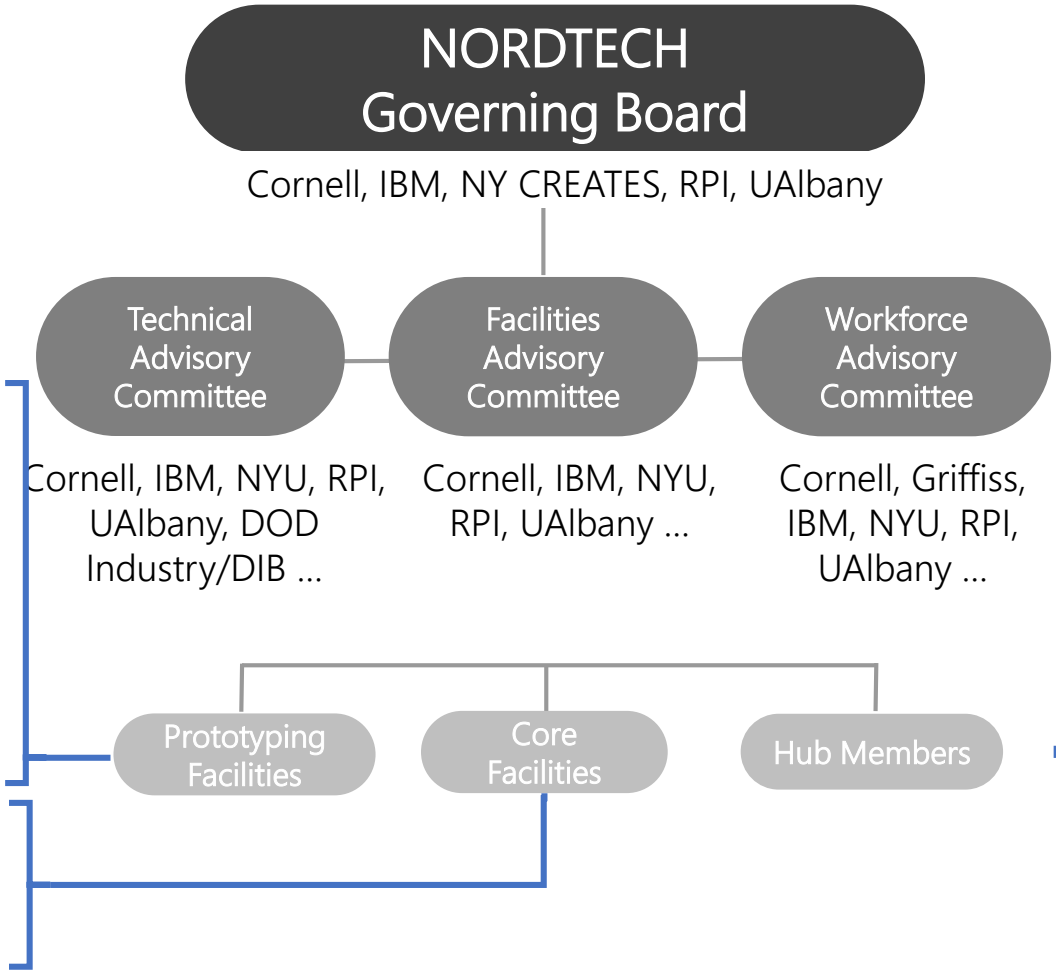


Leveraging Existing Facilities Across the Northeast Region

Hub Model



* ME Commons capital investment



MEMBERSHIP

Universities, Industry, DIBs, National Labs, & Commercial Foundries

	Member	Observer
Propose & Participate in Projects	*	-
Special Prototyping Pricing	*	-
Working Groups	*	-
Workshops	*	*
Networking Events	*	*
Marketing & Comms	*	*

https://www.nordtechhub.org/

Facilities + Hub Leadership + Members

NORDTECH Application Focus Areas

Commercial Leap Ahead

Solutions addressing scaling limitations as we move to advanced node devices and chiplets

Tools to harden security, particularly as postquantum attack algorithms emerge

Developing efficient power conversions to enable the rapidly evolving technology needs of the modern warfighter

AI Hardware

Developing novel materials for AI compute applications

Incorporating and transitioning novel materials into a standard CMOS flow (CMOS+X)

Developing and delivering composable AI chiplets in a pseudo-SOC that can deliver system level performance

Quantum Technology

Tools that allow for repeatable device fabrication

Producing fully integrated platforms in all forms of quantum technology (photonic devices, trapped-ion systems, diamond-based sensors, and superconducting devices)

Packaging for cryo-applications

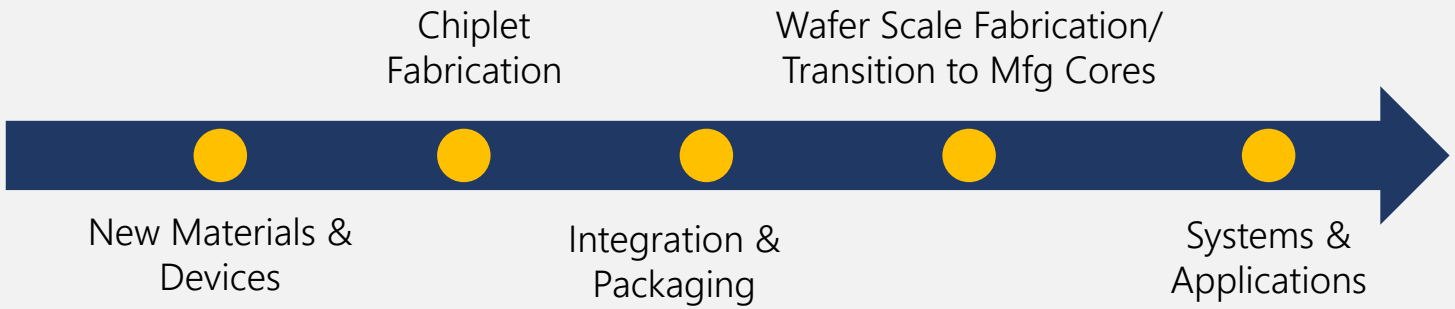
Ability to grow quantum sensor grade diamond films to allow

Secure Edge Computing

Developing chiplets that solve the data security needs of data-in-motion

Establishing platforms for the secure design and manufacturing of these chiplets

- Lab-based Technology Demonstrations
- Small Wafer Technology Development



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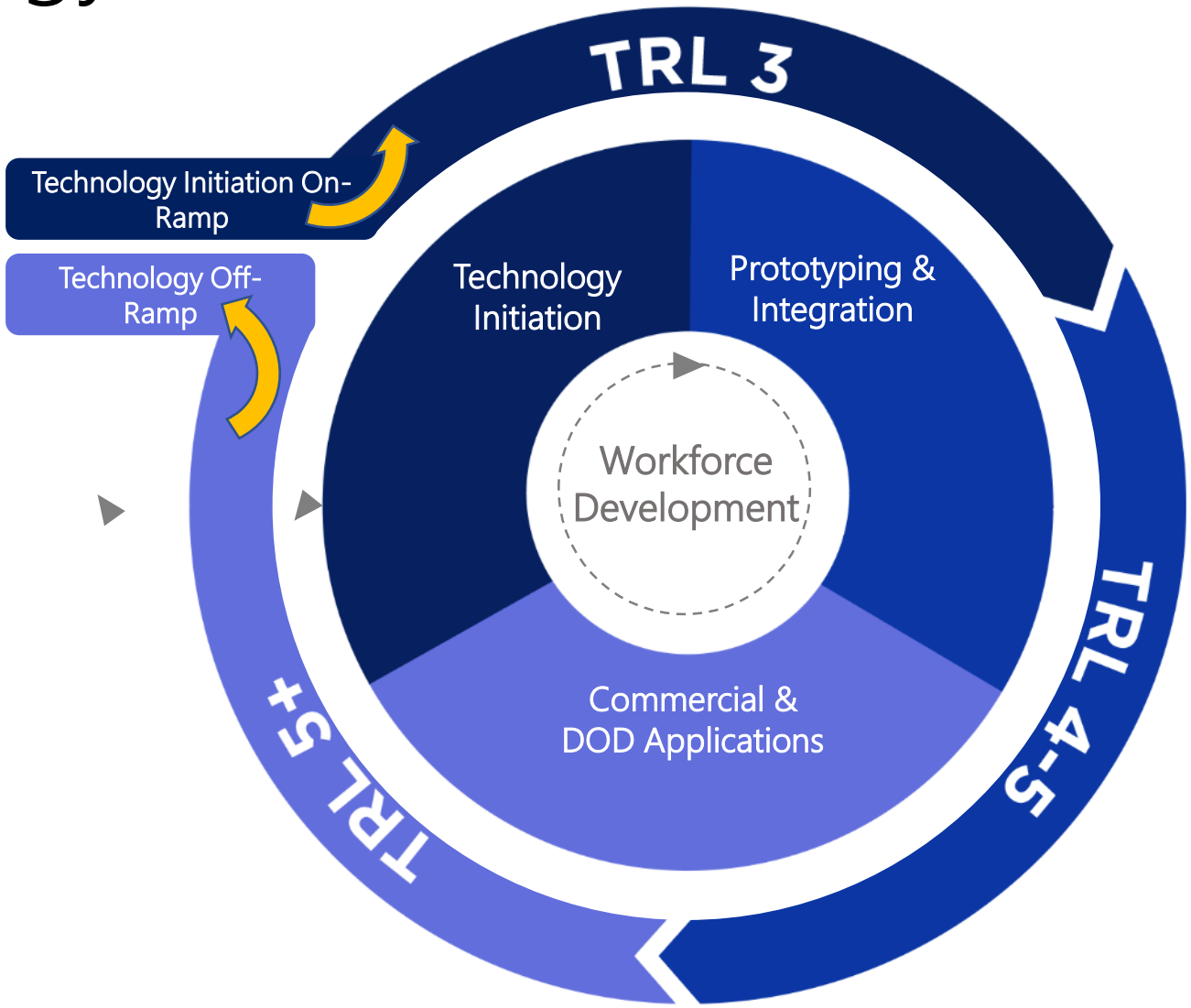
Technology Initiation to Commercialization



Accelerating Lab to Fab Transition

Hub Capabilities

Chip Design / Design Enablement
University & Industry Partners

Material & Device Development
University & Industry Partners

Lab-to-fab Transition

Advanced Metrology
- University Partners
- Brookhaven National Lab

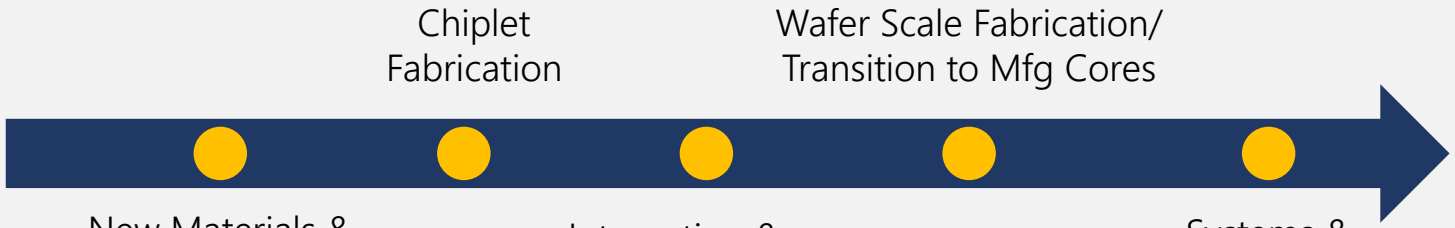
Wafer Fabrication (*Cores)
- UAlbany CNSE
- Cornell-CNF
- RPI
- IBM-MRL
- NY CREATES Albany NanoTech Complex
- *Global Foundries
- *GE
- *SkyWater

Chip Fab & Packaging

Chip / Chiplet / SOC Fabrication & Packaging
- Cores (GF, SkyWater, GE)
- IBM-Bromont
- Albany Nanotech Advanced Packaging Center
- NY CREATES Rochester Test, Assembly & Packaging (TAP) Facility

System/Application Testing and Evaluation
- University & Industry Partners
- Griffiss Institute / Innovare
- Defense Industrial Base (DIB) Partners
- DoD Partners
- NYU Center for Cybersecurity

- Lab-based Technology Demonstrations
- Small Wafer Technology Development



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Workforce Development – Existing Programs

Org	Program	Target Audience	# Students (5yr)
RPI	• BYOND – Experiential Learning in RPI's Cleanroom • Arch – Internships, Co-Ops, Independent Projects, with partners at Albany NanoTech and beyond	Undergrad Students	100+
NY CREATES and UAlbany CNSE	• Quantum, AI Hardware, Unit Process, Technician – Internships, Co-Ops, Independent Projects, with partners at NY CREATES' Albany NanoTech • VET S.T.E.P. Veterans Training	Undergrad, Graduate, Technician, Continuing Ed	275
Cornell	• eCornell Digital Delivery Platform • Nanofab-based Experiential Learning Courses and Workshops	• Professionals, Graduate, Lifelong Learners • K-12, Undergrad, Graduate, Professionals	500+
NYU	• CSAW – Cybersecurity Games and Conference (NYU)	Undergrad, Graduate, K-12, Community College	2,000
IBM	• SkillsBuild Program – Underrepresented communities	K-12, Undergrad, Graduate, Teachers	2.1M

K-12 Through Continuing Education

3. Next steps –

What we know now and what we learn and co-develop next.

Oct 16 PM: NORDTECH Member welcome in DC
Oct 17-18: ME Commons Kickoff Meeting in DC

FY24 Q1:

- NORDTECH agreement execution and standup
- NORDTECH Membership: How to formally join in Year 1
- DoD's first "Request for Solutions" (RFS) on technical projects
- Capital equipment ordering
- NORDTECH TAC, FAC, and WAC rosters
- NORDTECH Member communications cadence

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Latest DoD info on technical project needs (11 Oct 2023)

Artificial Intelligence

End State: Edge applications to enable overmatch performance in operational situation awareness decision-making in a wide variety of missions

Advances needed:

- Advances in High Performance, Energy Efficient, Reconfigurable, and Scalable Hardware
- Advances in Emerging AI Processing Hardware
- Advances in Test and Measurement Capability
- Advances in Software Stack for AI Chips
- Neuroscience-Inspired Designs
- Advances in Materials and Fabrication Processes
- Advances in Neural Network Architectures
- Advances in CMOS Integration of Novel Neuromorphic Materials
- Advances in Characterization

Commercial Leap Ahead Technologies

End state: Materials, devices, architectures, and processes to provide and/or enable revolutionary capabilities that the commercial industry has little to no current business interests that warrant their investment

Advances needed:

- Integration of Technologies with CMOS
- Advances in the High-Power Wide Bandgap Devices Ecosystem
- Advances in SOI Wafer Manufacturing and Wafer Bonding
- Research Fabrication Hub for Leap Ahead Technologies
- Optoelectronics Leap Ahead
- Advances in Emergent Material Platforms
- Advances in Standardization of Hybrid Optical-Electrical Signal Processing Architectures
- Advances in Power Management

Latest DoD info on technical project needs (11 Oct 2023)

Secure Edge/IOT Computing

End State: Novel materials, devices and architectures that enable future mission security and assurance

Desirable properties:

1. Advancements in SWaP+S metrics required for future edge computing assets
2. Physical and cyber protection capabilities to provide a holistic security posture to protect the control flow of the processor from external influence, ensure the integrity of the system during execution, prevent exfiltration of information and CPI, and 2 provide a means to recover from threat events
3. Capabilities to pair secure processors with untrusted high performance

Needs:

- Advances in SWaP Computing Approaches
- Advances in Hardware/Software Co-design and Integration

Quantum

End State: Assist in the development of quantum processor quality and capability as well as quantum s and quantum network support

Advances needed:

- Integration (advancement of multiple emerging microchip platforms, integration of those platforms, and novel test and measurement capability)
- Advances in Emerging Platforms and Materials
- Advances in Quantum Support Chips and Integration
- Advances in Test and Measurement Capability

Other Desired Outcomes:

- Cryogenic quantum systems with classical electronics
- Photonic integrated circuits with gain, low loss, and non-linear device sections on one platform
- Integrated single photon detectors and high-flux, high-fidelity entangled photon sources
- On-chip quantum information transduction between different qubit types

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Broaden, Enhance & Grow Lab-to-Fab Capabilities

Day 1 Readiness.

NORDTECH leverages existing public & private sector capital and infrastructure; amplified with ME Commons investment for capability & capacity expansion.

Open Access Ecosystem of Innovation.

NORDTECH provides access to university labs across the region, industry facilities, and to state-of-the-art fabrication facilities.

Paths to Commercialization.

NORDTECH builds on an existing ecosystem of capabilities with paths to commercialization to successfully support lab-to-fab transition.

- Commercial Leap Ahead
- AI Hardware
- Quantum Technology
- Secure Edge Computing

Capabilities and Expertise Enabling the Microelectronics Commons Across Application Areas